COMMUNICATION ENGINEERING AND ELECTRONIC TECHNOLOGIES

(Lecce - Università degli Studi)

Teaching RF MICROELECTRONICS C.I.

GenCod A005770

Owner professor STEFANO D'AMICO

Teaching in italian RF MICROELECTRONICS C.I.

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SSD code ING-INF/01

Reference course COMMUNICATION ENGINEERING AND ELECTRONIC

Course type Laurea Magistrale

Credits 6.0

Teaching hours Front activity hours: 54.0

For enrolled in 2019/2020

Taught in 2020/2021

Course year 2

Language ENGLISH

Curriculum PERCORSO COMUNE

Location Lecce

Semester

Exam type Oral

Assessment

Course timetable https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION	This is a course in RF Microelectronic: it is aimed at providing principles and tools to analyze and design RF analog circuits in CMOS integrated technology.
REQUIREMENTS	It is recommended to overcome the exam of Analog Electronics preliminary.
COURSE AIMS	After the course the student should be able to: 1) Describe the basic RF analog circuits (LNA, Mixer, etc...) and wireless transceiver architectures. 2) Evaluate the performance parameters and discuss complexity issues associated with different basic RF analog circuits and wireless transceiver architecture. 3) Demonstrate circuit analysis capability of not standard circuits. 4) Understand the technology limits in circuit design. 5) Use the simulator to analyse performance of RF analog circuits. 6) Correctly expose a RF circuit study or a wireless transceiver architecture description.
TEACHING METHODOLOGY	The Course forecasts 33 hours of theoretical lectures about technology description and fundamental RF circuit analysis and wireless architectures. The theoretical concepts are verified in laboratory by using state of the art circuit simulator. 21 hours of laboratory are forecast.

ASSESSMENT TYPE	The final (oral) exam consists of two cascaded parts: 1. the first part is based on the discussion about a report on the assigned RF circuit. The circuit must be simulated at the calculator. The student is asked to learn using the simulator, to illustrate the circuit design, to evaluate the performance parameters, and to define the operation of each part of the circuit. It is aimed to verify to what extent the student has gained knowledge and understanding of the use of the circuit simulator and the circuit analysis. 2. the second part is on circuit analysis of one of the RF basic circuits studied during the course or a wireless RF architecture; it is aimed to determine to what extent the student the circuit analysis capability, ability to identify and use data to formulate responses to well-defined problems, correct exposure of the circuit analysis, problem solving abilities and the capacity integrate different concepts.
OTHER USEFUL INFORMATION	Teaching material is available once the login to the website is done. Contact the instructor by email for questions or to have an appointment (stefano.damico@unisalento.it).

FULL SYLLABUS	▪ 1. Introduction to the RF and Wireless Technology -Wireless communication systems today -CMOS RF design issues ▪ 2. Basic Concepts in the RF Design -Non-linearitiy issues -Noise issue -Timing/frequency issues ▪ 3. Matching -Matching for power -Matching for impedance -Matching for noise -Design of matching circuits -Transmission line issues ▪ 4. Transceivers Architectures -RF transceiver at glance -Superheterodyne receivers -Direct receivers -Low-IF receivers -Need of I&Q down conversion -Direct conversion transmitters - Two steps transmitters ▪ 5. Low-Noise Amplifiers -LNAs in receiver front-ends -Impedance matching -S-parameters and stability -Circuit examples -Downconversion Mixers ▪ 6. Mixers -Basics of mixers -Active mixers -Passive switching mixers -Circuits examples ▪ 7. Oscillators -General considerations -Basic LC oscillator Topologies -Phase noise -Noise folding -Circuit examples ▪ 8. Frequency Synthesizers -Preliminary considerations -Phase Locked Loop frequency synthesizers -Noise and frequency spurs -Direct digital synthesizers ▪ 9. Cases of study: GSM and UMTS Receiver design -Standard descriptions -RX chain specs derivation -RX dimensioning
REFERENCE TEXT BOOKS	Behzad Razavi “RF Microelectronics”